

SHARKS OF THE AUSTRALASIAN REGION

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(Plate IV; text-figs. 1-2).

In 1940, the Royal Zoological Society of New South Wales published a handbook concerning sharks, stingrays, etc., in which an epitome of what was known about Australasian sharks was given (Whitley, 1940). During the ensuing 26 years, sharks have been studied sporadically from several viewpoints: as sources of vitamin-rich oils, as food, as a danger to man, and to some extent taxonomically and biologically. So some scattered information has been gathered concerning sharks' food, their migrations, growth, sex-ratios, size at maturity and of embryos, but the data are inconclusive as regards most of the species because, for worthwhile results, each must be studied over a long period from many specimens in a given area, and this has been impracticable. My own notes, not the result of full-time study, are very incomplete. Some new species were discovered and named and some biological data have been published elsewhere (see References). Points worth stressing in comparing allied species seem to be their sizes, especially lengths at which they first reproduce, numbers of vertebrae, numbers of embryos in each litter and whether or not they are separated by compartments in the uterus. The sizes of gummy sharks, for example, differ on the eastern and western sides of Australia.

SIZE AT FIRST BREEDING OF SHARKS

Total lengths at which certain sharks first breed:—

- Molochophrys galeatus*—about 2 feet.
- Galeolamna dorsalis*—mature about 5½ feet.
- Galeolamna pleurotaenia tilstoni*—breeding male 4 feet, female 5 feet.
- Galeolamna eblis*—breeds at about 10 feet.
- Galeolamna macrurus*—breeds at (about 10 feet), certainly at 12 feet.
- Galeolamna cauta*—breeds at 4 feet.
- Galeolamna spenceri*—mature at 5 feet.
- Galeolamna fitzroyensis*—ovulating at 4 feet.
- Galeocerdo cuvier*—breeds at 11 feet 8 inches or less.
- Mapolamia spallanzani*—mature at 4 feet 3 inches.
- Koinga kirki*—gravid at 2 feet.
- Notogaleus rhinophanes* (School Shark)—matures at nearly 4 feet.
- Rhizoprionodon*—gravid at 19 inches to 2 feet.
- Protozygaena taylori*—gravid at about 2½ feet.
- Furgaleus ventralis*—breeds at just over 4 feet.
- Emissola antarctica*—male matures at about 32 inches.
- Emissola ganearum*—breeds at 4 feet.
- Flakeus*—matures between 2 and 3 feet.
- Proscymnodon*—breeds at about 4 feet.

BROOD

The number of embryos in a litter varies enormously, the female tiger shark, for example, may bear from 10 to 63 embryos. Some sharks have more young in one uterus than the other. Egg-layers usually produce 1 or 2 eggs in a clutch, but the brood-numbers of most sharks are not yet known. *Emissola antarctica* has generally 3 to 7 embryos in New South Wales, 5 to 23 in New Zealand. The Western Australian *E. ganearum* has 13 to 22.

* Presented at the Eleventh Pacific Science Congress of the Pacific Science Association, held at the University of Tokyo, Japan, August-September, 1966, and organized by the Science Council of Japan.

Data are sparse for Australasian Sharks but the following field-notes give at least an approximate idea of the situation.

The dog shark, *Flakeus*, has 1 or 2 embryos and *Koinga* has 5 to 7. *Rhizoprionodon acutus* has 2 to 6 embryos in a litter.

Lamna whiteleyi has 3 embryos in a litter.

Brachaelurus waddi has 7 embryos in a litter.

Furgaleus ventralis has 11 embryos in a litter.

Notogaleus rhinophanes has 23 to 50 embryos in a litter.

Sphyrna lewini—has 25 to 40 embryos in a litter.

Centrophorus plunketi—36 embryos in a litter.

Orectolobus maculatus—37 embryos in a litter.

Carcharhinus mackiei—46 embryos in a litter.

In the genus *Galeolamna* there is diversity in numbers of embryos according to species:

G. pleurotaenia tilstoni has 2 to 5 embryos in a brood;

G. dorsalis has 10; and *G. macrurus* has 10 to 18.

The number of embryos may be less an indication of zoological relationship than a function of size at motherhood or some ecological requirement of the shark concerned. Embryos are all together in the uterus of the Western Australian *Emissola ganearum*. They are in separate compartments in *E. antarctica* also in *Galeolamna cauta*, *G. dorsalis*, *G. pleurotaenia tilstoni*, *Notogaleus rhinophanes* and in *Furgaleus ventralis*, though in the last-named the compartments are very thin and easily torn or overlooked.

VERTEBRAE

V. Springer and Garrick (1964, Proc. U.S. Nat. Mus., 116: 73-96, pl. i) have tabulated many vertebral counts for sharks. I add the following from my field notes, based, not on X-rays, but on dissections.

Oxynotus bruniensis, 92 vertebrae.

Emissola ganearum, 124 vertebrae.

Galeolamna cauta, 160 and 163 vertebrae.

Galeolamna eblis, 174 vertebrae.

Galeolamna spenceri, 185 vertebrae.

Mapolamia spallanzani, 193 and 195 vertebrae.

Not only the total number of vertebrae may be of importance in separating species or races, but the numbers of vertebrae between the skull and certain well-defined levels along the body.

A few examples are given in Table 1.

COMMENTS ON SELECTED SPECIES

From an annotated list of some 116 Australasian sharks which was tabled at the Science Congress at Tokyo, the following were selected for comment.

(1) *Molochophrys galeatus*

A Crested Port Jackson Shark hatched from an egg in Taronga Zoological Park Aquarium, Sydney, in April 1938 and, after 11 $\frac{3}{4}$ years, itself laid eggs. The growth-rate of the young shark has been recorded in *Proc. Roy. Zool. Soc.*

TABLE I.—VERTEBRAL COUNTS OF SOME WESTERN AUSTRALIAN SHARKS

Name	Sex	Total length (mm.)	Total no. of vertebrae	To below origin of first dorsal	To below second dorsal origin	To over ventral origin	To over anal origin	To between ends of bases of anal and second dorsal fins.	To root of tail.
<i>Galeolamna cauta</i>	♂	965	163	26	—	—	64	—	86
<i>Galeolamna cauta</i>	♀	918	160	25	66	—	—	—	90
<i>Galeolamna eblis</i> (Allotype)	♂	1375	174	31	69	—	70	—	87
<i>Mapolamia spallanzani</i>	♂	1265	193	30	87	57	86	95	113
<i>Mapolamia spallanzani</i>	♀	1090	195	30	86	58	84	95	114
<i>Emissola ganearum</i>	♀	1375	124	21	48	33	54	—	74

N.S.Wales 1942-43 (1943): 11, *et. ibid*; 1948-49 (1950): 28. In February 1950, this shark was 28½ inches long and weighed 8½ lb.

(2) *Hemiscyllium strahani*, sp. nov.

There is a new species of *Hemiscyllium** from New Guinea, alive in Taronga Park Aquarium, Sydney, where it has been in captivity since about 1960 without showing any evident growth (except for a slight increase in length in 1966) or colour change. It differs from its congeners in coloration.

Mouth nearer end of snout than front edge of eye. Pupil oblique, slit-like. A fold behind mouth across chin. Head widest at gills. Back without dermal ridges.

Dorsal fin-angles extended behind, not rounded. Dorsal fins slightly larger than ventrals. Origin of first dorsal fin behind level of base of ventral; barely over its lobe. Pectorals and ventrals rounded. Anal fins shorter than subcaudal fin. Female. Head 120 mm.; total length 2 feet, 5½ inches (measured 23rd May, 1967).

*Family *Hemiscylliidae*

Genus *Hemiscyllium* Muller & Henle, 1838.

Hemiscyllium Muller & Henle, 1838, Mag. Nat. Hist. (n.s.), 2 January 1838: 34 (genus caelebs). *Id.* A. Smith, 1838, Proc. Zool. Soc. Lond., 5, 1837 (publ. 13 Feby 1838): 86. Haplotype, *Squalus ocellatus* Bloch. *Id.* Muller & Henle, 1838, Syst. Plagiost. (1): 16. Haplotype, *H. ocellatum* (Gmelin). The original author of *ocellatum* was Bonnaterre, 1788, Tabl. Encycl. Meth. Ichth.:8, from "La mer du sud" [probably Cooktown, Queensland]. The genus was reviewed by Fowler, 1941, Bull. U.S. Nat. Mus., 100 (13): 81. *Hemiscyllium ocellatum* has been observed in Taronga Park Aquarium, Sydney, to stay close to the bottom of the tank during the day but Mr. Douglas Boness of the aquarium staff tells me that the sharks are liable to jump out of the water at night. Females lay two eggs every fourteen days and they take 120 days or so to hatch, but the egg-cases are sometimes chewed or eaten by males. The egg-case gapes at the top and the developing embryo can be readily inspected from about 2 months after oviposition. One newly hatched juvenile (4 days or less old) was 147 mm. in total length on 23rd May, 1967. Usually they average 5½ inches in length on hatching and are cryptozoic, entering shells or holes in rocks. They are cream and blackish banded, rather like young *Chiloscyllium punctatum* but with the dorsal fins more dark-spotted. The characteristic ocelli of *Hemiscyllium ocellatum* appear soon after hatching. Mr. Boness kept one specimen under separate observation in water of 80°F. temperature and reported on its development as follows.

Egg laid 7th November, 1963, opened by hand 12th March, 1964, the yolk-sac was the size of a match-head and the young shark was 5 inches long when removed from the egg. On 17th March, 1964 it was eating prawn, the yolk-sac having been absorbed. On 15th April, it measured 6½ inches, and on 22nd July, 6¾ inches, the bands becoming spots; on 1st October, 1964 it was 8 inches long, light cream with more distinct spots; on 23rd April 1965, 12½ inches long with colour-markings as in parents; on 16th May 1965, it died by jumping from its tank and was 13 inches long.

Another embryo, after 5 weeks in its egg, was very active and had external gills and a large yolk-sac.

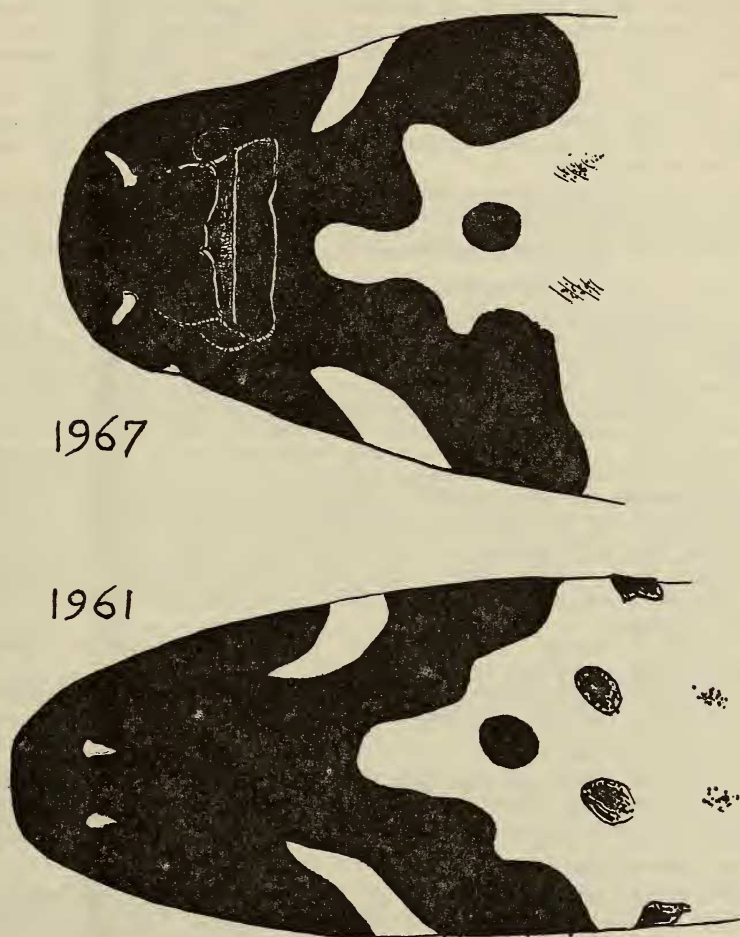


Figure 1.—Holotype of *Hemiscyllium strahani* from New Guinea. Sketches, natural size, of ventral surface of head in the years 1961 and 1967. The nasal tentacles are spread laterally and the mouth-parts are indicated in the 1967 sketch.

Colour, in life, yellowish-brown of various shades. Nose black. Fourteen dark brown cross-bars along back from interorbital to tail; these generally divide before reaching ventral surface. Most of the upper parts, before the tail, with milky spots, each about size of eye. A dark ocellus behind last gill-openings. Fins narrowly edged white. Areas between brown cross-bars cream to yellowish. Most of ventral surface of head black but tips of nasal cirrhi are cream and a lunule of lighter colour extends into the black area on each side; posteriorly the breast is light with several round black spots. The black areas of ventral parts of head come up over cheeks and snout. Spiracle cream with brown spots. Two dark brown marks on each dorsal fin anteriorly. The dark ocellus behind last gill-slit is much smaller than that of *ocellatum* or *trispiculare*. Inside of mouth cream.

Loc.: New Guinea. Unique holotype in Taronga Zoological Park Aquarium, Sydney. I have seen nothing like it in aquaria in Asia and elsewhere.

Named after Mr. Ronald Strahan, M.Sc., Director, Taronga Zoological Park.

Hemiscyllium hallstromi, sp. nov.

Also living in Taronga Park Aquarium are two specimens of a larger species than *strahani*, which differ from it, *freycineti*, *trispiculare* and *ocellatum* in coloration, notably in having no spots on the head before the interorbital. Its ground-colour is very pale golden tan on which are large, dark brown spots; the chin is light-toned. The large ocellus behind the gill-slits is partly surrounded by four or five other large ovate spots. The spots on body and fins are larger and fewer than in other species and with very much wider light interspaces. About eight cross-bars do not descend below the back, which is otherwise white from just before the first dorsal fin backwards. Fins edged cream; pectorals plain or with very few spots. Eye light blue with oblique slit-like pupil.

Dorsal fins with pointed lobes. First dorsal origin over posterior part of ventrals. Slight median dorsal ridge. First dorsal little larger than ventral fin. Anal fin much shorter than subcaudal. Less than 30 dark spots along middle of sides.

Loc.—New Guinea. Holotype male and paratype alive in Taronga Zoological Park Aquarium, Mosman, Sydney.

I have pleasure in naming this new species after Sir Edward Hallstrom, K.B., F.R.Z.S., Director Emeritus of Taronga Park.

(3) *Rhincodon typus*

The Whale Shark has been seen off the eastern Australian coastline on many occasions and several more times since the records were listed in *Australian Natural History* June 1965: 44-46, 3 figs.

(4) *Galeolamna* spp.

The Whaler Sharks (as species of "*Carcharhinus*" and *Galeolamna* are named in Australia), are notoriously difficult to identify. There is a tendency by some authors to unite various nominal species into one, or a few, variable species, but it seems to me that this course is unwise, because there are obviously more kinds than are usually recognized, their characters are fairly constant, and their sizes at first maturity often differ markedly so that interbreeding appears to be prevented. Data are incomplete but, as far as is known, *G. eblis* and *G. macrurus* breed when about 10 feet long whilst many of the other species breed before attaining 6 feet in length. As Stewart Springer (1938) observed, "I have no doubt but that the size range of adults is a useful character for the separation of species."

Because the type-species of *Carcharhinus* is still in doubt and modern attempts to select one seem to involve departing from established canons of nomenclature, I use Owen's genus *Galeolamna* for the Whaler Sharks, the holotype of the type-species of which, *G. greyi*, I examined years ago in the museum of the Royal College of Surgeons in London. (See plate IV).

(5) *Galeocerdo cuvier*.

Australasian data are not detailed enough to sketch the life-history of the Tiger Shark, but may link up later with information from extralimital sources. Length-weight ratios are approximately as follows.

4 feet	=	22 lbs.
11 to 12 feet	=	710-825 lbs.
12 to 13 feet	=	850-1151 lbs.
13 to 14 feet	=	1028-1395 lbs.
14 to 15 feet	=	1183-1324 lbs.
15 to 16 feet	=	?
16 to 17 feet	=	1300 lbs.
18 feet	=	3330 lbs.

Females up to 10 feet long have been found to be immature but they breed at 11 feet 8 inches and at just over 12 feet. A very variable number of embryos may be produced, up to 2 or 2½ feet in length.

According to Messrs. Joyce & Watkins' Fremantle (Western Australia) fishery returns, small and large tiger sharks were caught at all times of the year, but there were waves of small ones in October (about 5 to 7 feet), January and April (4½ to 6 feet), and by May large ones (10 feet or longer) were coming in again.

In New South Wales, the tiger shark has been taken in August, but is usually caught between November and April.

(6) *Emissola* spp.

The White-spotted Gummy Sharks of Western Australia are much larger than those of New South Wales, Victoria and Tasmania and are specifically distinct. New South Wales gummies, *Emissola antarctica*, have a total length of 900 mm. or less and a weight of up to 5½ lbs. (modal class of trawled specimens 751 to 800 mm; most frequent weight between 4 and 4½ lbs.). New South Wales females are larger, up to 1250 mm. (weight 18½ lb.): modal class 851 to 900 mm.; most frequent weight, 6¼ to 6½ lb. Males are mature at 800 to 880 mm. (32-35 inches).

Bunbury (Western Australia) gummies, *E. ganearum*, observed in June-July 1943, were: one male, 1285 mm. long = 16 lb., and 8 females, 1040 to 1354 mm. = 10½ to 28 lb. (average 1235 mm. = 20 lb.), but off Albany (W.A.) on 5th October 1943, a female of 1570 mm. = over 45 lbs. was caught. This specimen had 16 embryos, 8 male and 8 female, 305 to 330 mm. long.

(7) *Carcharodon albimors*.

Gunther, in 1880, estimated that a White Shark from Port Fairy, Victoria, would have been 36½ feet long, and Bigelow & Schroeder give the allied species' maximum size as about 21 feet long and 7,100 lb. in weight. Vertebrae of a Tasmanian specimen said to have been 28 feet long, are exhibited in the Queensland Museum, Brisbane.

Mr. A. Dean hooked one 16 ft. 10 in. long and weighing 2,664 lb. at Ceduna, South Australia in April 1959. The smallest Australian one was noted as 7 ft. 5 in. long, weighing 130 lb. in commercial returns from Fremantle, Western Australia.

The smallest free-living white shark was just over 4 ft. from Algoa Bay (J. L. B. Smith) and the *Illustrated London News* once illustrated a 14 ft. female from Alexandria, Egypt, weighing 2½ tons (5,600 lb.), with at least nine embryos, 2 ft. long and weighing 108 lb. A mature male Great White Shark, in mating condition, from Florida, U.S.A., in February 1967, was 11 ft. 1 in. long and weighed 1,060 lb. (Anon., 1967, Cape Haze Mar. Lab. Quart. Newsletter, March 1967:2).

In view of Postel's (1958) observation that the white shark appeared regularly off the coast of Tunis in the latter half of May, I have drawn up a

rough, and admittedly incomplete "calendar" of occurrences off Australia's coasts from which the following picture emerges.

Most of the big-game specimens are taken in South Australian waters in January, although September and November to April captures have been made there. In Victoria it has been taken in April and July; in New South Wales in October and from January to June; in Queensland in May and June. Perhaps a leisurely and not very direct migration is indicated, or the sharks may stay near whales or in suitable regions. I have no monthly details from New Zealand. Mr. A. Dean, who has caught many large South Australian specimens, states (1966) of *Carcharodon*, "Despite a proved capacity for long migrations individuals favour a particular area and will repeatedly return to it." One female shark he recognized from a characteristic scar after 13 years; her weight had apparently not increased.

(8) *Halsydrus mccoysi*.

I have seen the remains of the Orkney Islands "Sea-serpent" in the Royal College of Surgeons' Museum, London, on which the genus name *Halsydrus* was based; they were those of a basking shark.

A contribution towards a bibliography of the basking shark is appended (Appendix A).

For cosmetic purposes, the ladies of Japan are anxious to obtain squalene, an oily preparation from basking sharks and dogfishes. Since, however, the ladies of Japan are already beautiful it seems a pity to sacrifice such uncommon and interesting animals as basking sharks and the less known squaloids like *Centrophorus* for this purpose. In the past, seals have been decimated for their pelts, egrets and other birds have been slaughtered for their plumes, and many rare and lovely creatures have vanished in the fleeting cause of fashion. The basking shark is mainly known in Australasia from beach-strewn examples, about 27 of which have been noted from literature and museum specimens from 1883 when McCoy discovered it in Victoria until 1956 (See Table II).

When months of occurrence have been reported they have been May, September and November for Victoria; May, August and September for New South Wales and, for New Zealand, February, April, May "every [Southern] spring" and "summer months", August, October, November and December.

Size of specimens has been from about 8 ft. long to 34 ft. 3 in. (N.Z., 1889), usually between 9 and 13 feet and with perhaps a peak in the graph at 25 feet.

Sex in most cases was not reported but when this was mentioned there were 6 males to 1 female, an unreliable ratio and contrary to the findings of Harrison Mathews (1963) in Old World seas.

(9) *Euprotomicrus bispinatus*.

Recorded from westward of Australia by Bigelow and Schroeder in 1957, the latest information on this species has been put on record by Parin (1964, Trudy Akad. Nauk SSSR. Okeanol. 73: 163, etc., figs. 2-4).

Acknowledgments

Most of the work upon which this paper is based was done in the field in different States of Australia and in Papua during the 1940's when the author was employed by the Council for Scientific and Industrial Research; the rest, (in Australia, New Zealand and some Pacific Islands) during his term as Curator of Fishes at the Australian Museum, Sydney. To both these institutions he is grateful for laboratory and library facilities. Thanks are also due to Miss Elizabeth Pope, of the Australian Museum, who kindly dissected sharks selected from the catches of the Red Funnel Trawlers of Sydney. The co-operation of officials of the State Fisheries Departments in Perth, Hobart and Melbourne is gratefully acknowledged. Information was also derived from shark-meshing

contractors, fish markets, fisheries statistics and records of anglers' catches, but considerations of space will not allow for full details to be included here. Mr. D. Boness of Taronga Park Aquarium, Sydney, has also been helpful in several ways.

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TABLE II.
Australasian records of Basking Sharks.

No.	Date	Locality	Remarks	Recorder
1	1883, Nov.	Portland, Victoria	Length 30' 6", ♂. Fed on pteropods	Macleay, 1883 & 1884; McCoy, 1885, pl. 104; Barrett, 1932.
2	1902, May	Off Williamstown, Hobson's Bay, Victoria	12' 11", ♂.	Kershaw, 1902.
3 & 4	—	Port Fairy, Victoria	♀ & half-grown ♂.	Kershaw, 1902.
5	1889, Nov.	Near mouth of Wade River, near Devonport, N.I., New Zealand	34' 3"	Cheeseman, 1891; Waite, 1907.
6	1901, May	Twofold Bay, New South Wales	9'.	Waite, 1902.
7	1901, Aug. 14	Eden, New South Wales	10' 6" ♂, fed on <i>Munida subrugosa</i> .	Waite, 1902; Bridge, 1904 and Gudger, 1915.
8 & 9	—	South Australia	8' & 10'	Zeitz, 1908.
10	—	Fowler's Bay, South Australia	25' ♂, cast in S. Austr. Museum.	Waite, 1921 & 1923.
11	—	Auckland, New Zealand	—	Phillipps, 1924.
12	"every spring"	Whangaparaoa Peninsula, New Zealand	—	—
13	—	Banis Bay, Tasmania	—	Lord, 1927.
14	1914	South Australia	—	Anon., a. 1956.

15		Great Australian Bight				Ward & Fountain, 1907, as <i>Rhinodon</i> .
16	1918, Dec.	Te Mingi, Paraparaumu, near Wellington, New Zealand		28' 6"		Phillipps, 1946.
17	1930, Sept.	Mungo Beach near Myall Lakes, New South Wales		25'		A. L. Marshall, 1931; Whitley, 1934 & 1940.
18	1929, Dec.	Off Kapiti Island, near Wellington, New Zealand		Several seen		by W. J. Phillipps.
19	1931, April	Wairoa, Hawkes Bay, New Zealand		12', spotted.		Phillipps, 1946.
20	1932, Feb. 7	Off Wellington wharves, New Zealand				
21	1932, May 14	Makara, New Zealand		17' 2", ♂		Phillipps, 1946.
22		Wellington etc., New Zealand		12' 10"		Phillipps, 1946.
23		Encounter Bay, South Australia		10' 6"		Hale, 1932.
24	1934, Aug.	Kapiti, New Zealand		12' 10"		Phillipps, 1946.
—		New Zealand		Feeds on zooplankton.		McCann, 1954.
25		Port Taranaki, New Plymouth, New Zealand (12th N.Z. specimen).		9' = 134 lb.		Newscutting, about 1958? and MS. photo. by J. A. F. Garrick.
26	1956, Sept. 11	Warmambool, Victoria		About 20'.		Anon., b, 1956.
27	1956, Oct.	Off Goose Bay, Kaikoura, New Zealand		16'. Fed on plankton. "Shoals [of basking sharks] seen off the west coast of South Island [New Zealand] in summer months."		Anon., c, 1956.

The above list has been compiled from the literature; possibly other specimens have been taken commercially but not recorded.

APPENDIX A.

Contribution towards a bibliography of the Basking Shark.

A splendid bibliography of the Basking Shark, covering publications from the earliest times to about the year 1941 was provided by Bigelow & Schroeder (1948: 147). In 1931, Mr. W. J. Phillips of the Dominion Museum, Wellington, New Zealand, and I compiled a manuscript synonymy of the Basking Shark and detailed its occurrence in Australian and New Zealand seas. Our account was never published but we independently included briefer references to the Basking Shark in separate papers of ours published since 1931. The *Zoological Record* for recent years has supplied numerous references to reports of Basking Sharks, mainly from the Northern Hemisphere. There is, therefore, no need to traverse the ground covered by the above sources, nor to particularize mention of the Basking Shark in various editions, translations, or secondary accounts of such authors as Cuvier; moreover, a number of local European and Japanese publications are unavailable for consultation; but a supplementary list of references, mostly additional to those in Bigelow & Schroeder (1948) and in recent *Zoological Records* is offered below in the hope that it may contribute to a better understanding by later students of the biology of the Basking Shark.

Although no Basking Sharks appear to have been washed ashore or captured by Australians or New Zealanders for a decade or so, the species has come under the notice of Japanese commercial interests.

The first reference to the possible occurrence of the Basking Shark in the Pacific Ocean was not a satisfactory record: in Frederick Debell Bennett's *Narrative of a Whaling Voyage around the Globe* (London: Bentley), vol. 2, 1840: 240, we read:

"While cruising in the South Pacific, we occasionally observed . . . "Bone-sharks" . . . If we admit that an error exists on the subject of there being whale-bone in its mouth, it appears probable that the Bone-Shark is allied to, or identical with, the Basking-shark (*Squalus maximus*) . . ."

Bennett was in the whaler *Tuscan* from 1833 to 1836. He was not near Australia or New Zealand, so his "South Pacific" more likely refers to the Marquesas or Society Islands, from which, however, the Basking Shark seems never to have been recorded.

The next Pacific record appeared in "Forest and Stream" in 1877, according to Dean's *Bibliography of Fishes*. As no Australian library holds this publication, I applied to the Library of Congress, Washington, U.S.A. for information. Mrs. Winifred Desmond, of that Library kindly supplied xerox copies of two articles from *Forest and Stream* of vol. 7, 1877; 356 and 8:17. The former, by M. Harvey, was entitled "The Basking Shark in Newfoundland Waters" and reported one found there in August 1876; 30 feet long, *Selache maximus*. The second paper, "The Basking Shark in the Pacific", by E. R. Wilson, states that he had seen the whalers' "Bone Shark" in the South Seas and on the coast of Africa. In 1861, he saw one between Tumbez and Guayaquil, Ecuador, and in 1859 saw barrels of basking shark oil shipped to Callao, Peru. Thus Wilson's Pacific records were not Australasian.

Australasian records of Basking Sharks from the 1880's to the 1950's are listed in Table II. An indication of world distribution is given in figure 2.

"Seehunde" Goyeau, 1760, Hamburg Mag., 24:531 (*vide* Muller & Henle, 1839 and Dean, 1923). "Brygd-Fisk" Fries, 1772, K. Svensk. Vet. Akad. Handl. 157 and Kiobenh. Selsk. Skr., 10, 1772: 202 (*vide* Dean, 1923).

Squalus maximus Berkenhout, 1795, Synopsis Nat. Hist. Gt. Brit., ed. 3, 1: 61, no. 10, ex Pennant. *Id.* Blainville, 1811, Ann. Mus. Hist. Nat. Paris, 18c: 88, pl. 6, fig. 1 (not seen). *Id.* Hunter, 1834, Cat. Comp. Anat. Mus. R. Coll. Surg., 2:63 & 86. *Id.* Jenyns, 1835, Man. Brit. Vert. Anim., Nov. 1835: 563, no. 193. *Id.* Richardson, 1836, Faun. Bor. Amer. 3:291. *Id.* Templeton, 1837, Mag. Nat. Hist. (Charlesw.), 1:413. *Id.* Owen, 1852, Descr. Cat. Comp. Anat. Mus. Roy. Coll. Surg., ed. 2, 1:51, 145 & 203. *Id.* Smyth, 1854, The Mediterranean: 204. *Id.* Montague, 1861, Dict. Univ. Hist. Nat. (D'Orbigny), 9: 549. *Id.* Schlegel, 1869, Nat. Hist. Neder., Visschen: 191, pl. 19, fig. 1.

Scoliophis atlanticus Anon., 1817, Rept. Comm. Linn. Soc. N. England on Serpent: 44 (*vide* Sherborn, Index Animalium). New England.

Selache maxima (-us, -um) Agassiz, 1835, Poiss. Foss., 3:87, pl. F, figs. 8, 8a. *Id.* Swainson, 1838, Nat. Hist. Classif. Fish. Amphib., 1:119. *Id.* Allman, 1842, Fourth Ann. Rept. Dublin Nat. Hist. Soc., 1841-42, *vide* Wright, 1877, Ed. Bonaparte, 1846, Cat. Metod. Pesc. Europ.: 17, no. 62. *Id.* Baird, 1868, Amer. Agricult. 27:130 (*vide* Dean, 1916). *Id.* Hadfield, 1875, Zoologist (2) 10: 4415 (Isle of Wight, England). *Id.* Allman, 1876, Nature, 14:368. *Id.* Wright, 1877, Nature 15:292 and 16:61. *Id.* Lutken, 1880, Vid. Medd. Kjobenh., 1879: 45 & 62 and Tidsskr. Pop. Frem. Nat., 26:56. *Id.* Macleay, 1883, Abstr. Proc. Linn. Soc. N.S.Wales, Nov. 28, page iii and Proc. Linn. Soc. N.S.Wales, 8, 1884: 464 and 9, 1884:62, *ex* McCoy, MS (Portland, Victoria—first Australian record). *Id.* Macleay, 1886, Proc. Roy. Soc. Tasm. 1885:300. *Id.* Cheeseman, 1891, Trans. N. Zeal. Inst., 23:126 (Wade R., N.Z.). *Id.* Grieg, 1897, Nature: 85. *Id.* Collett, 1903, Forh. Vidensk. Selsk. Christ., 1:121. *Id.* Murie, 1906, Zoologist, 10:396. *Id.* Mazzarelli, 1908, Riv. Mens Pesca Pavia

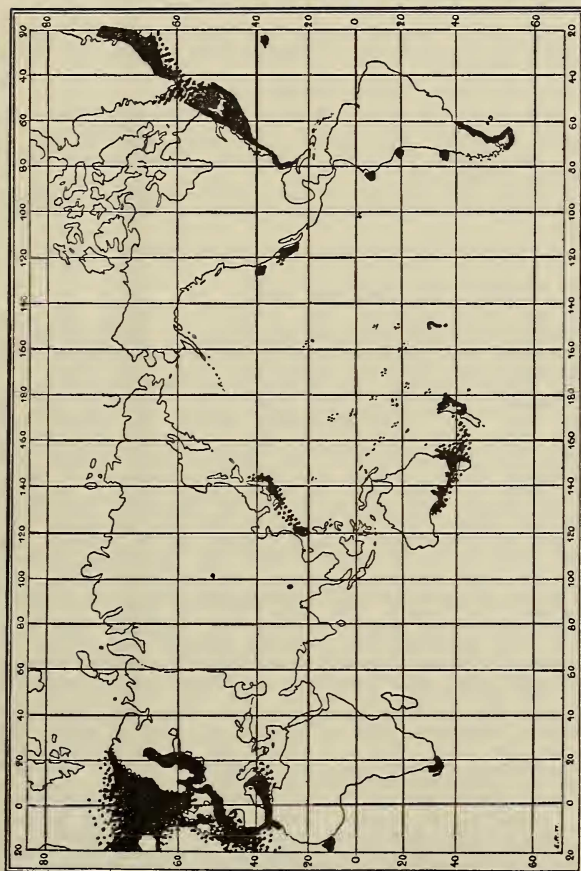


Figure 2.—World distribution of the Basking Shark.
Letters indicate type-localities for the earliest names given to regional forms,
as follows:

- A. *maximus* Gunner, 1765 (and 14 synonyms). Europe.
- B. *angitona* Rafinesque, 1810 (2 syns.). Mediterranean.
- C. *atlanticus* Anon., 1817 (2 syns.). United States of America.
- D. *maccoyi* Barrett, 1932. Australia.
- E. *normani* Siccardi, 1960. South Atlantic.

The Japanese form does not appear to have been separately named.

- 10:165, and Parona, in *ibid.*: 263 and Monti, in *ibid.*: (2) 5, 1910:158. *Id.* Paris, 1912, Riv. Sci. Nat. Milano, 3:221. *Id.* Senna, 1920, Monitore Zool. Ital. Firenze 31:35, pl. 3 (skull). *Id.* Saemundsson, 1922, Vid. Medd. Dansk. Foren., 74:190 et *ibid.*, 84, 1927: 183, pl. 5, 2 figs (Iceland). *Id.* Valle, 1922, Congress Gen. 28 Soc. Pesca Trieste: 31, 4 figs. *Id.* Vinciguerra, 1924, Rend. Union Zool. Ital. Genova: 36. *Id.* Jenkins, 1925, Fish. Brit. Isles: 314, pl. 122.
- Id.* Refs. in Zoological Records for 1932 and 1933. *Id.* Fraser Darling, 1947, Natural History in the Highlands and Islands: 171, coloured pl. 27a (p. 220). Female swims in front of male as they cruise.
- Squalus rhinoceros* Gill, 1864, Proc. Acad. Nat. Sci. Philad., 1864: 259, in synonymy, ex DeKay, 1842. Maine, U.S.A.
- Selache rostrata* Pavesi, 1874, Ann. Mus. Civ. Stor. Nat. Genova, 6:36, pls. 1-3. Italy.
- Selache* sp. Gunther, 1880. Intro. Stud. Fish.: 322.
- Selache pennanti* Noetling, 1885, Faun. Tertiary Prussia: 49. New name for Pennant's Basking Shark regarded as distinct from *S. maxima* Day, Cornish—*fide* Grant, 1886, Zool. Rec., 1885:17. England.
- ?*Selache glauconitica* Noetling, 1885, Faun. Tertiary Prussia: 49. Fossil.
- Rhinodon* Aflalo, 1896, Nat. Hist. Austr.: 221 & 249. Australia. Not *Rhinocodon* Smith, 1829.
- Cetorhinus (Selache) maximus* Boulenger, 1904, Camb. Nat. Hist.: 453, fig. 259. *Id.* Escribano, 1909, Bol. Soc. Espan. Hist. Nat., 9:340, pl. (Portugal; *fide* Dean). *Id.* Dean, 1923, Bibliogr. Fishes: 619.
- Rhinodon typicus* Ward & Fountain, 1907, Rambles of Austr. Nat.: 120 (Great Australian Bight. Record unreliable). Not *Rhinocodon typicus* Muller & Henle, the South African Whale Shark.
- Cetorhinus* sp. Leriche, 1908, Comptes Rendus Acad. Sci. Paris, 146:875. Fossil, *fide* Zoological Record.
- Selache (Cetorhinus) maximus* Gudger, 1915, Zoologica, 1:382.
- Cetorhinus maximus* McCoy, 1885, Prodrum Zool. Vict. 2 (dec. 11): 11, pl. 104 (Portland, Victoria). *Id.* Ogilby, 1889, Proc. Linn. Soc. N.S.Wales, (2) 3:1772, ex McCoy. *Id.* Lucas, 1890, Proc. Roy. Soc. Vict. (2) 2:45, ex McCoy. *Id.* Kershaw, 1902, Vict. Nat., 19:62 (Hobson's Bay, Vic.). *Id.* Waite, 1902, Rec. Austr. Mus., 4:263 (Eden, N.S.Wales). *Id.* Jordan & Fowler, 1903, Proc. U.S. Nat. Mus., 26:625 (Japan, ex Matsubara). *Id.* Stevenson, 1904, Rept. U.S. Fish. Comm. 28, 1902: 227. *Id.* Bridge, 1904, Camb. Nat. Hist. 7:453 (Australian waters). *Id.* Stead., 1906, Fish. Austr.: 233. *Id.* Waite, 1907, Rec. Canterb. Mus., 1:6 (New Zealand). *Id.* Zietz, 1908, Trans. Roy. Soc. S. Austr., 32:291. *Id.* Elmhirst, 1913, Glasgow Nat., 5:66. *Id.* Jordan, Tanaka & Snyder, 1913, J. Coll. Sci. Tokyo Univ., 33:17, fig. 8. *Id.* Engelhardt, 1913, Sitzb. K. Akad. Wiss. Berlin 4, Suppl. Band 3: 35 & 97, fig. 3 (distribution). *Id.* Gudger, 1915, Science, 42:653. *Id.* McCulloch, 1919, Austr. Zool., 1:223, fig. 24a and Illustr. Austr. Encyclop. 1, 1925:142. *Id.* Waite, 1921, Rec. S. Austr. Mus., 2:22, fig. 29 and Fish. S. Austr., 1923:41, fig. *Id.* Phillipps, 1924, N. Zeal. J. Sci. Tech., 6:266, fig. 10. *Id.* Dixon & Eddy, 1925, Personality of Water Animals: pl. opp. p. 105 (large American specimen). *Id.* Jordan & Hubbs, 1925, Mem. Carneg. Mus., 10:102. *Id.* Lord, 1927, J. Pan-Pacif. Res. Inst. 2 (4):12 (Banis Bay—new rec. Tasmania). *Id.* Bonnot, 1929, Calif. Fish & Game, 15 (2):175. *Id.* Berger, 1930, Nat. Hist. (New York), 30(4):443. *Id.* Phillipps, 1930, Arch. Hydrobiol., 21:499. *Id.* A. L. Marshall, 1931, Education Gazette (Sydney), 25 (2): 20, fig. (Near Myall Lakes, N.S.Wales, notes and photo. Teeth in Australian Museum, Sydney). *Id.* Chu, 1931, Biol. Bull. St. John's Univ., 1:3 (China). *Id.* Norman, 1931, Hist. Fishes: 39, fig. 18d (gill-rakers). *Id.* Tanaka, 1932, Jap. Fish., no. 21, and of later Japanese authors. *Id.* as "Basking Shark", Hale, 1932, 48th. Ann. Rept. Mus. S. Austr., 1931-32:9 (Encounter Bay, S. Austr.). *Id.* Fang & Wang, 1933, Contrib. Biol. Lab. Sci. Soc. China (Zool.), 8 (8):243, fig. 13. *Id.* Norman, 1933, Proc. Zool. Soc. Lond., 1933:1121 (Falkland Iss.). *Id.* Tchang Si, 1933, Bull. Soc. Zool. France, 58: 423, fig. 1. (Abnormal branchial apparatus of Chinese example). *Id.* Young & Mazet, Shark! Shark!: 266, etc. *Id.*, as "Basking Shark", J. G. Marwick, 1934, Orcadian, Feb. 1, 1934 (Low's "Natural History of Orkney" (1813) quoted). *Id.* A. E. Cooper, 1934, Lonsdale Library 17, Sea Fishing: 105 (Shetlands, etc. Nearly 8,000 lb.). *Id.* Borri, 1934, Atti Soc. Toscana Sci. Nat. Pisa, 44: 93, figs. & ref. to 1929 paper on p. 102. *Id.* F. de Buen, 1935, Not. Res. Inst. Esp. Oc. (2) 88: 6, 9, 16 & 29, fig. 20. *Id.* Walford, 1935, Calif. State Fish. Lab. Fish. Bull., 45: 39, with original figure. *Id.* as "Blue-nosed shark" Sphere (London), Sept. 10, 1938: 400, fig. (Weymouth, England; 12 ft.). *Id.* McKenzie, 1939, Proc. Nova Scotia Inst. Sci. 20 (1):14 (Nova Scotia, up to 10,700 lb. according to graph). *Id.* Gudger, 1940, Science 91:357 (Norway). *Id.* McKenzie, 1940, Proc. Nova Scotia Inst. Sci., 20 (2):42 (25¼ ft. should have weighed 7,200 lb.). *Id.* Refs. in Zoological Records, various years. *Id.* Beebe & Tee Van, 1941, Zoologica, 26:98, fig. 4. *Id.* Chapman, 1942, Copeia, 1942(1):51 (Washington). *Id.* Bonham, 1942, Copeia, 1942 (4):264, figs. (claspers). *Id.* Navarro, 1943, Bol. Real. Soc. Esp. Hist. Nat., 41:55 (Balearics). *Id.* Hart, 1946, Discov. Rept., 23: 259, etc. (Patagonia). *Id.* Barnard, 1944, Pict. Guide S. Afr. Fish.: 14, pl. 2, figs. 4a-b (South African recs. Summer migrant). *Id.* Hillaby, 1948, Discovery, 9: 369, 10 text-figs. *Id.* Scattergood, 1948, Copeia, 1948 (2):143 (Gulf of Maine). *Id.* J. B. Phillipps, 1948, Calif. Fish & Game, 34:11, figs. *Id.* Fitch, 1948, Calif. Fish & Game, 34:219, figs.

- 77-78 (California). *Id.* Gudger, 1948, J. Elisha Mitch. Scient. Soc. 64:41, pl. 7, figs. 1-2 (grows to at least 45 feet). *Id.* Bigelow & Schroeder, 1948, Mem. Sears Found., 1:147, figs. 1D, Yanez, 1949, Rev. Biol. Marina (Valparaiso), 1 (3):233, fig. 41 (Chile). *Id.* Tortonese & Trotti, 1949, Centr. Talass. Tirreno Pubbl., 1:17. *Id.* Roedel & Ripley, 1950, Calif. Fish. Bull., 75: 21, etc., fig. 30 (California). Bears live young). *Id.* Matthews & Parker, 1950, Proc. Zool. Soc. Lond., 120 (3): 535, pls. 1-8 & 15 text-figs. (Anatomy and biology). *Id.* Tortonese, 1950, Arch. Zool. Ital. Torino, 35:119. *Id.* Refs. in Zoological Records, various years. *Id.* G. Maxwell, 1952, Harpoon at a Venture: 25, figs. 1-82. *Id.* Scattergood, 1952, Copeia, 1952 (3):205 (Gulf of Maine. Male of 348cm. = 650lb. Liver 12.5 per cent of total weight). *Id.* P. F. O'Connor [1953], Shark-O, *passim*. *Id.* Parker & Boeseman, 1954, Proc. Zool. Soc. Lond., 124 (1):185, 3 plates and figs. in text (Food, growth, moult of gill-rakers). *Id.* McCann, 1954, J. Bombay Nat. Hist. Soc., 52: 331, pls. 1-2. (New Zealand. Feeds on zooplankton). *Id.* Anon. (a), 1956, Rec. S. Austr. Mus., 12, plate opp. p. 104 (South Australia, 1914). *Id.* Munro, 1956, Handbk. Austr. Fish., no. 14. *Id.* Anon. (b), 1956 The Standard [newspaper, Warrnambool, Victoria], Sept. 12 and 13, 1956 (Warrnambool, Victoria; 11 Sept. 1956). *Id.* Clarke, 1956, Discov. Rept., 28: 261, pl. 2, fig. 4 (Horta. From stomach of sperm whale). *Id.* B. L. Gordon, 1957, Nat. Hist. (N. York), May 1957: 272, figs. (Nova Scotia. Up to 50 feet). *Id.* F. G. Wood, 1957, Copeia, 1957 (2): 153 (Florida). *Id.* Greenbank, 1957, Copeia, 1957 (2):156 (Chesapeake Bay). *Id.* Backus, 1957, Copeia, 1957 (3):246 (Massachusetts. Juvenile). *Id.* Anthony Watkins, 1958, The sea my hunting ground, *passim*, illustrated. *Id.* Leim & Day, 1959, J. Fisher. Res. Board Canada, 16 (4):504. *Id.* Hardy, 1959, Open Sea, 2:69, pl. 4 & text-fig. *Id.* Backus, 1960, Copeia, 1960 (3): 244. *Id.* Torchio, 1960, Act. Soc. Ital. Mus. Civico Milano, 99 (4):303, fig. 1. *Id.* Siccardi, 1960, Rev. Mus. Argent. Cienc. Nat. Bernard Rivadaria (Buenos Ayres), 6 (2):61, plates & text-figs. *Id.* Refs. in Zoological Records, various years. *Id.* Baldwin, 1961, Copeia, 1961 (4):476. *Id.* Heegaard, 1961, Rec. Austr. Mus., 25:177 (copepods). *Id.* Scott, 1962, Fish. S. Austr.: 26, figs. *Id.* Cadenat, 1962, Bull. Inst. France Afr. Noire, 24 (A) 1: 305, pl. 2 (Senegal). *Id.* Hubbs, 1962, Copeia, 1962 (3):677 (Cuba; new record. Ref. to Torre, 1945). *Id.* Harrison Matthews, 1963, Smithson. Rept., 1962; 415-421 (The shark that hibernates. Structure, habits, spermatophore, viviparity. Smallest specimen about 6 feet. Sex-ratio). *Id.* Chen, 1963, Biol. Bull. 19 Tunghai Univ.: 37 (Taiwan). *Id.* v.d.Land, 1965, Zool. Meded., 40(32):293 (Distribution and parasites). *Id.* Parker & Stott, 1965, Zool. Meded., 40 (34), pl. 1, figs. 1-2 (Age size and vertebral calcification). *Id.* Leim & Scott, 1966, Fish. Atlant. Coast Canada: 29, fig. *Id.* Squire, 1967 Copeia, 1967(1): 247, fig. 1.
- Tetroras maccoyi* Barrett, 1932, Sun Nature Book 4: 13, fig., ex Whitley & Phillipps, MS. Australasia. Type from Portland, Victoria, in National Museum, Melbourne. *Id.* Coppleson, 1933, Med. J. Austr., April 15, 1933: 458.
- Halsydrus maccoyi* Whitley, 1934 Mem. Qld. Mus., 10: 197, pl. 29, figs. 1-3. (Williamstown, Victoria. South Australia. Great Australian Bight. New Zealand locs. Mungo Beach, most northerly rec. in New South Wales. 25 feet). *Id.* Whitley, 1940, Fish. Austr. 1:132, figs. *Id.* Powell, 1947, Native Anim. N. Zealand: 62, fig. 298. *Id.* Goadby, 1959, Sharks: 32-33, fig.
- Halsydrus maximus* Whitley, 1939, Austr. Zool., 9:241 (23 trivial names in synonymy). *Id.* Fowler, 1940, Bull. U.S. Nat. Mus., 100 (13): 113. *Id.* Phillipps, 1946, Dom. Mus. Rec. Zool., 1(2):9 (New Zealand locs. and lengths). *Id.* Hass, 1958, We come from the sea: 225. *Id.* Parrott, 1958, Game fish. sharks N. Zealand: 107, fig. *Id.* Stead, 1963, Sharks & Rays Austr.: 200, fig. 18.
- Cetorhinus maccoyi* Mathews & Parker, 1950, Proc. Zool. Soc. Lond., 120 (3):536. Australia.
- "Sea Creature" Anon., 1950, The Sphere (London), June 24, 1950: 464, 2 figs. (English Channel).
- Cetorhinus maximus infanuncula* (new form) Deinsé & Adriani, 1953, Zool. Meded. 31: 307, pls. 17-18. (Holland. 21 specimens between 1821 & 1952. Absence of gill-rakers in some).
- "Basking Shark" Anon. (c), 1956, Evening Post [newspaper, Wellington, New Zealand], 27 Oct. 1956. (Off Goose Bay, Kaikoura, New Zealand. 16 ft., Oct. 1956. Fed on plankton. "Shoals seen off the West Coast of the South Island in summer months"). *Id.* Moreland, 1958?, New Zealand newspaper (Port Taranaki, New Zealand. 9 ft. = 134 lb.).
- Cetorhinus maximus maccoyi* Siccardi, 1960, Rev. Mus. Argent. Cienc. Nat. Bernard Rivadaria (Buenos Ayres), 6(2): 61.
- Cetorhinus maximus normani* Siccardi, 1960, Rev. Mus. Argent. Cienc. Nat. Bernard Rivadaria (Buenos Ayres). 6(2): 84, plates & figs. South Atlantic.

"Nomenclator Zoologicus. Edited by Marcia A. Edwards, B.Sc. and A. Tindell Hopwood, D.Sc. Vol. VI 1946-1955" (London: The Zoological Society of London), 1966, pp.

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The first five volumes of this *Nomenclator Zoologicus* were produced by Dr. S. A. Neave who died at the end of 1961. They recorded the bibliographical origins of the name of every genus and subgenus in zoology published between the years 1758 and 1945 and have been noted by this reviewer elsewhere*. "This volume, the sixth in the series, covers the period from 1946 to 1955 and also contains many earlier names which for various reasons were omitted from the previous volumes", and corrigenda are incorporated in the main body of the work as well as being listed separately.

The gratitude of zoologists is due to the editors of this sixth "Neave" for the care they have taken with this exacting work, in which very few misprints have been found. The compilation is time-saving, as it obviates much tedious searching through the annual indexes of the *Zoological Record*, whilst the cross-references are of the utmost value. It is perhaps a tribute to the *Nomenclator Zoologicus* that (at least in ichthyology) practically no preoccupied new generic names are proposed nowadays.

So, once again, heartfelt thanks are expressed to the *Nomenclator Zoologicus* and to Miss Marcia Edwards and Dr. A. T. Hopwood, its indefatigable editors.

— G. P. Whitley.

* Whitley, 1939, *Austr. Zool.*, 9 (3): 262; 1940, *Austr. Naturalist*, 10 (7): 241-243; and 1950, *Proc. Roy Zool. Soc. N.S.Wales*, 1948-49: 44.